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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte KATSUMI YAMAMOTO

Appeal 2009-006967
Application 10/603,729
Technology Center 2600

Before ROBERT E. NAPPI, JOHN C. MARTIN,
and ELENI MANTIS MERCADER, *Administrative Patent Judges*.

MARTIN, *Administrative Patent Judge*.

DECISION ON APPEAL¹

¹ The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, or for filing a request for rehearing, as recited in 37 C.F.R. § 41.52, begins to run from the “MAIL DATE” (paper delivery mode) or the “NOTIFICATION DATE” (electronic delivery mode) shown on the PTOL-90A cover letter attached to this decision.

STATEMENT OF THE CASE

This is an appeal under 35 U.S.C. § 134(a) from the Examiner's rejection of claims 1-19, which are all of the pending claims.

We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

A. Appellant's invention

Appellant's invention is an image sensor having a micro-lens array in which the lenses are separated by ridges. Specification [0001].²

Figures 4 and 6 are reproduced below.

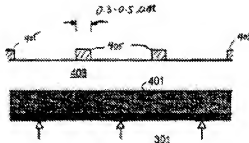


FIGURE 4

² Citations herein to Appellant's Specification are to the Application as filed rather than to corresponding Patent Application Publication 2004/0263665 A1.

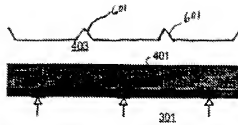


FIGURE 6

Figures 4 and 6 (and also Figures 5, 7, and 8, reproduced *infra*) are cross-sectional views of a semiconductor substrate illustrating different steps of a method for forming Appellant's image sensor (*id.* at [0008]). As shown in Figure 4, a photoresist layer deposited over the top planarizing layer 403 has been patterned to leave photoresist ridges 405 (*id.* at [0020]). Figure 6 shows that using isotropic etching to remove photoresist ridges leaves triangular ridges 601 in planarizing layer (*id.* at [0024]).

Figure 5 is reproduced below.

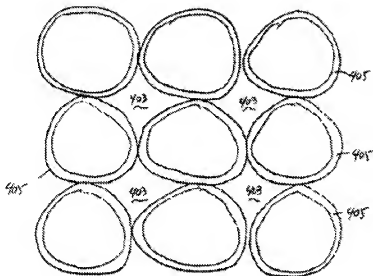


Figure 5

Figure 5 is a top view of circular triangular ridges formed over pixels of an image sensor (*id.* at [0009]).

Figures 7 and 8 are reproduced below.

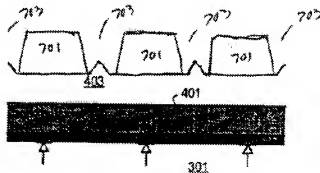


FIGURE 7

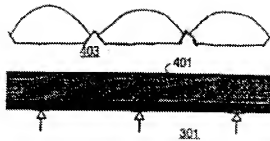


FIGURE 8

Figure 7 shows the structure after a layer of micro-lens material has been deposited and after portions 703 have been removed to leave micro-lens portions 701 (*id.* at [0027]-[0028]). Figure 8 shows the structure after micro-lens portions have been heated to a reflow temperature (*id.* at [0029]).

B. The claims

The independent claims before us are claims 1, 8, and 15, of which claim 1 reads as follows:

1. An image sensor comprising:
 - a plurality of pixels formed in a semiconductor substrate, each pixel including a light sensitive element;
 - a micro-lens over each of said light sensitive elements;
 - and
 - a raised ridge structure surrounding each of said micro-lenses, wherein said raised ridge structure has a triangular cross-section and at least partially supports said micro-lens, wherein the micro-lens overlays a base portion of the raised ridge structure.

Claims App. (Br. 12).

C. The references

The Examiner's rejections are based on the following references:

Nakai	US 5,396,090	Mar. 7, 1995
Tan	US 6,043,481	Mar. 28, 2000
Assadi	US 6,166,369	Dec. 26, 2000

D. The rejections

Claims 1-3, 6, 8-10, 13, and 15-18 stand rejected under 35 U.S.C. § 103(a) for obviousness over Tan in view of Assadi. Final Action 5, para. 3.

Claims 4 and 11 stand rejected under 35 U.S.C. § 103(a) for obviousness over Tan in view of Assadi and Applicant's Admitted Prior Art. *Id.* at 10.

Claims 5, 7, 12, 14, and 19 stand rejected under 35 U.S.C. § 103(a) for obviousness over Tan in view of Assadi and Nakai. *Id.* at 11.

THE ISSUE

Appellant's principal argument is that the references teach away from combining their teachings in the manner proposed by the Examiner.³

³ See *Ex parte Frye*, 94 USPQ2d 1072, 1075 (BPAI 2010) (precedential) ("If an appellant fails to present arguments on a particular issue — or, more broadly, on a particular rejection — the Board will not, as a general matter, unilaterally review those uncontested aspects of the rejection."). Designated as precedential at
(Continued on next page.)

ANALYSIS

Appellant argues independent claims 1, 8, and 15 as a group (Br. 9, para. D). We select claim 1 as representative of these claims. 37 C.F.R. § 41.37(c)(1)(vii) (2008).

Tan discloses an optoelectronic device that collects, transmits, and detects light such that light collection is maximized and light loss minimized (col. 2, ll. 25-27). The device employs lateral spacing guides that facilitate maximum packing of lens elements, commonly referred to as a “maximum fill factor” (col. 2, ll. 44-47).

Figure 4 of Tan is reproduced below.

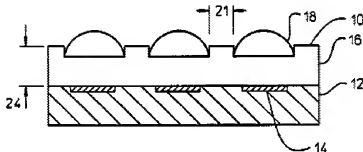


Figure 4

Figure 4 illustrates a cross section of an assembly in accordance with an embodiment of Tan’s invention (col. 3, ll. 17-18). A substrate 12 contains optoelectronic elements 14, which can be, for example, receptive elements (col. 3, ll. 34-37). A light-transmissive layer member 16 or spacer

member of transmissive polymer or dielectric material has a contoured surface 10 defining a ridged pattern “exhibiting raised portions 19 and depressed portions 20 of the contoured surface” (col. 3, ll. 37-45). Although neither of numerals 19 and 20 appears in Figure 4, numeral 21 (not mentioned in Tan’s description) appears to designate the width of the raised portions or ridges (19).

Figure 9B is reproduced in part below.

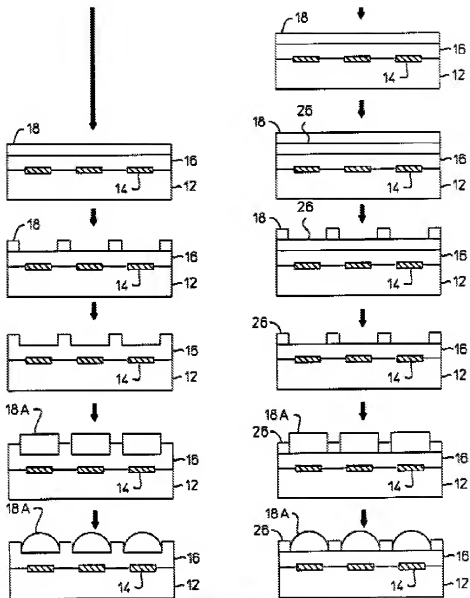


Figure 9B

Figure 9, which consist of Figures 9A and 9B, show the steps used to make the assemblies depicted in Figures 4 and 5 (col. 5, ll. 20-21, 30-31).

The blocks in the left path in Figure 9B correspond to the Figure 4 embodiment. As shown in the last two blocks in that path, after lens

material 18A has been deposited between the ridge elements in the light transmissive material 16, heating causes the lens material to form convex lens elements bounded by the ridge elements. The Examiner finds that “the raised ridge structure (19) at least partially supports the micro-lens (as shown in Fig. 9b).” Final Action 5-6.

For a teaching of forming Tan’s ridge elements with a triangular rather than rectangular cross section, the Examiner relies on Assadi, which discloses a microelectronic photosensitive device having reflective surfaces for reflecting incident light towards the photosensitive element. Assadi, col. 1, ll. 42-46.

Figure 3 of Assadi is reproduced below.

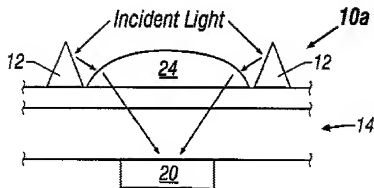


FIG. 3

Figure 3 is a partial, enlarged side elevational view of an embodiment of Assadi’s invention (col. 1, ll. 53-55). Light reflected from the reflective surfaces of reflective elements 12, which are depicted in this figure as being triangular or wedge-shaped, is diffracted by the microlens 24 towards the photosensitive device 20 (col. 2, ll. 5-8, 46-49). In this way, reflective

elements 12 and microlens 24 work together to improve the fill factor of the photosensitive device 20 (col. 2, 49-51). Although elements 12 form an orthogonal pattern in Figure 2, they “could also be curved so that a relatively circular arrangement may be provided around each photosensitive device 20” (col. 2, ll. 30-34). Assadi further discloses that the microlenses can be formed before or after the formation of reflective elements 12. *See* col. 3, ll. 55-57 (“In some embodiments using reflective surfaces and microlenses, it may be desirable to form the microlenses first, for example using conventional microlens material.”). Assadi also explains that the microlenses take the form of conventional microlenses, which “may be formed by depositing a suitable material at 90° C. for thirty seconds, and postbaking and reflow at 140° C. for ninety seconds, as examples” (col. 3, ll. 58-60).

The Examiner concluded that “[i]t would have been obvious . . . to have included the raised ridge structure having a triangular cross-section, as taught by Assadi, with the image sensor of Tan” because “Assadi teaches . . . [that] having a raised ridge structure with a reflective triangular cross-section allows more light to be reflected to the micro-lens for diffraction towards the photosensitive device, thereby improving the fill factor of the photosensitive device.” Final Action 6. The Examiner responded to Appellant’s “teaching away” argument by explaining that the references are properly combinable because they are both concerned with improving the fill factor (i.e., light collecting efficiency) of microlenses:

Assadi teaches the reflective surfaces (12) and the microlens (24) work together to improve the fill factor of the photosensitive device (20) (Col. 2, lines 42 – 53) and Tan teaches the lateral spacing guides facilitate maximum packing of lens elements, such optimized packing is commonly referred to as “maximum fill factor” (Col. 2, lines 42 – 47).

(Answer 12.)

Appellant argues that the references teach away from the proposed combination because combining Tan with Assadi “makes *Assadi* unsatisfactory for its intended purpose” (Br. 7). *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007) (when the prior art teaches away from a combination, that combination is more likely to be nonobvious); *In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1382 (Fed. Cir. 2007) (“a reference teaches away from a combination when using it in that combination would produce an inoperative result”). Specifically, after correctly noting that the apparent purpose of the ridges 19 in Tan is to separate the microlenses 18 from each other and that the apparent purpose of the reflective surfaces 12 in Assadi is to more efficiently diffract incoming light into the pixel 20, Appellant argues that

[t]he fact that the surfaces 12 are reflective is the operative factor. Any modification that diminishes the purpose of the reflective surfaces 12 in *Assadi* would not be appropriate. That is, if a person of ordinary skill were to combine the ridges in *Tan* with the reflective surfaces in *Assadi* more light *would not* be reflected to the microlens 24 of *Tan*. To the contrary, during the reflow process the microlens would take up space on the reflective surface 12. As a result, *less light* would be reflected to the

microlens. This would defeat the purpose of *Tan* [sic: Assadi], which is to increase the amount of light reflected to the microlens. (Br. 7.) We are not persuaded by this argument. Although the ordinarily skilled artisan would have recognized that covering the lower surface portions of Assadi's reflective elements 12 with microlens material will reduce the amount of reflected light, we are of the opinion that the artisan, in view of *Tan*, would have accepted such a reduction in reflected light in exchange for being able to use the lower surface regions of the triangular elements 12 to define the outer edges of the microlenses (formed using a conventional reflow process) and thereby increase the size and light-collecting ability of the microlenses, as taught by *Tan*. Alternatively, the artisan would have recognized, in view of Assadi, that the size and thus the light-collecting ability of the microlenses in *Tan*'s Figure 4 assembly can be increased by forming the ridge elements with a triangular (rather than rectangular) cross section and causing at least the lower surface regions of the triangular ridge elements to be covered by the microlenses. Furthermore, the artisan would have recognized that this modification will result in an increase in the light-collecting efficiency whether or not the ridge elements are reflective but that reflective ridge elements will yield a greater increase in light-collecting efficiency because their uncovered surface portions will reflect light to the microlenses.

For the foregoing reasons, we are of the opinion that the Examiner's rejection comports with the *KSR* principles that "when a patent claims a structure already known in the prior art that is altered by the mere

substitution of one element for another known in the field, the combination must do more than yield a predictable result,” 550 U.S. at 416, and

[c]ommon sense teaches . . . that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle. . . . A person of ordinary skill is also a person of ordinary creativity, not an automaton.”

Id. at 420-21. Appellant’s arguments (Br. 8) that the results of combining the reference teachings would not have been predictable and that the artisan would have had no reasonable expectation of success in combining the teachings are unpersuasive.

For the foregoing reasons, we will sustain the rejection of independent claims 1, 8, and 15 for obviousness over Tan in view of Assadi. For the same reasons, we will sustain the rejection on same ground of dependent claims 2, 3, 6, 9, 10, 13, and 16-18, which are not separately argued. *In re Nielson*, 816 F.2d 1567, 1572 (Fed. Cir. 1987).

We will also sustain the rejection of dependent claims 4 and 11 for obviousness over Tan in view of Assadi and the Admitted Prior Art because Appellant has not separately argued the merits of those claims. *Id.* We will likewise sustain the rejection of dependent claims 5, 7, 12, 14, and 19, which are not separately argued, for obviousness over Tan in view of Assadi and Nakai. *Id.*

In summary, all of the Examiner’s rejections under 35 U.S.C. § 103(a) are sustained.

Appeal 2009-006967
Application 10/603,729

DECISION

The Examiner's decision that claims 1-19 are unpatentable is affirmed. No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1). *See* 37 C.F.R. § 1.136(a)(1)(v) (2009).

AFFIRMED

babc

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